

(51) International Patent Classification:
H01L 21/66 (2006.01)

(21) International Application Number:

PCT/US2014/037915

(22) International Filing Date:

13 May 2014 (13.05.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/823,156	14 May 2013 (14.05.2013)	US
14/274,972	12 May 2014 (12.05.2014)	US

(71) Applicant: **KLA-TENCOR CORPORATION** [US/US];
KLA-TENCOR CORPORATION, Legal Department, One
Technology Drive, Milpitas, California 95035 (US).(72) Inventors: **SEZGINER, Abdurrahman**; 19020 Withey
Road, Monte Sereno, California 95030 (US). **PAN, Gang**;
4360 Laird Circle, Santa Clara, California 95054 (US). **LI,
Bing**; 520 Singley Drive, Milpitas, California 95035 (US).(74) Agent: **MCANDREWS, Kevin**; KLA-TENCOR CORP.,
Legal Department, One Technology Drive, Milpitas, Cali-
fornia 95035 (US).(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: MACHINE LEARNING METHOD AND APPARATUS FOR INSPECTING RETICLES

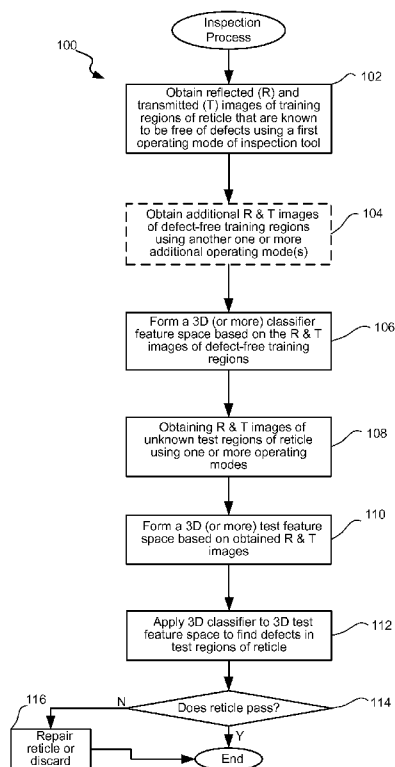


Figure 1

(57) Abstract: Apparatus and methods for inspecting a photolithographic reticle are disclosed. A reticle inspection tool is used at one or more operating modes to obtain images of a plurality of training regions of a reticle, and the training regions are identified as defect-free. Three or more basis training images are derived from the images of the training regions. A classifier is formed based on the three or more basis training images. The inspection system is used at the one or more operating modes to obtain images of a plurality of test regions of a reticle. Three or more basis test images are derived from the test regions. The classifier is applied to the three or more basis test images to find defects in the test regions.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:

26 March 2015

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/037915**A. CLASSIFICATION OF SUBJECT MATTER****H01L 21/66(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L 21/66; G01B 11/30; G01B 11/24; G01N 21/88; G01N 21/00; G01N 21/956; G06K 9/00; G06T 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: reticle, inspect, basis training image, classifier, basis test image

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-346627 A (TORAY ENG. CO., LTD.) 15 December 2000 See abstract, paragraphs [0013]-[0014], [0021]-[0095] and figures 1-10.	1-26
A	US 2006-0203233 A1 (ZONGQIANG YU) 14 September 2006 See abstract, paragraphs [0059]-[0066] and figures 4-10.	1-26
A	US 2003-0086081 A1 (YONATAN LEHMAN) 08 May 2003 See abstract, paragraphs [0068]-[0120] and figures 1-3.	1-26
A	JP 2007-212201 A (HITACHI HIGH-TECHNOLOGIES CORP.) 23 August 2007 See abstract, paragraphs [0019]-[0041] and figures 1-15.	1-26
A	US 2012-0002860 A1 (KAORU SAKAI et al.) 05 January 2012 See abstract, paragraphs [0077]-[0098] and figures 3-9.	1-26



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

28 January 2015 (28.01.2015)

Date of mailing of the international search report

28 January 2015 (28.01.2015)

Name and mailing address of the ISA/KR

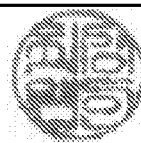
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701,
Republic of Korea

Facsimile No. ++82 42 472 3473

Authorized officer

CHOI, Sang Won

Telephone No. +82-42-481-8291



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037915

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000-346627 A	15/12/2000	None	
US 2006-0203233 A1	14/09/2006	US 2005-0134840 A1 US 2008-0106740 A1 US 6850321 B1 US 7046355 B2 US 7295301 B2 US 7580124 B2	23/06/2005 08/05/2008 01/02/2005 16/05/2006 13/11/2007 25/08/2009
US 2003-0086081 A1	08/05/2003	US 6466314 B1 US 7079235 B2	15/10/2002 18/07/2006
JP 2007-212201 A	23/08/2007	JP 2007-192688 A JP 5028014 B2 US 2007-0177787 A1 US 2012-0207382 A1 US 8103087 B2 US 8582864 B2	02/08/2007 19/09/2012 02/08/2007 16/08/2012 24/01/2012 12/11/2013
US 2012-0002860 A1	05/01/2012	JP 2006-220644 A JP 2010-151824 A US 2006-0159330 A1 US 2013-0307963 A1 US 7848563 B2 US 8467594 B2 US 8824774 B2	24/08/2006 08/07/2010 20/07/2006 21/11/2013 07/12/2010 18/06/2013 02/09/2014